

REMARKS

Claims 1-18 are all the claims pending in the application. Reconsideration and allowance of all the claims are respectfully requested in view of the following remarks.

Personal Interview with the Examiner

Applicants thank the Examiner for the courtesy extended to their personal representative during the interview conducted on July 19, 2004. In addition to that noted on the Examiner's Interview Summary dated July 19, 2004, the Examiner also discussed changing the reference to the periodic table from the European designations to the US designations. Specifically, the Examiner noted that it may be more convenient for the US patent application to designate the elemental metal of the carbide as belonging to the IVB, VB or VIB families in the Periodic Table. The Examiner's Interview Summary dated July 19 is otherwise complete and no further summary thereof is believed to be necessary.

Informalities

Applicants have amended the references to the Periodic Table so as to use the US designations instead of the European designations for the elemental metals of the carbides. Specifically, the reference "IVA, VA or VIa" has been changed to --IVB, VB or VIB--, which correspond to the US Periodic Table designations for the exemplary elemental metals Ti, Ta, and W. See, for example, the paragraph bridging pages 20-21, page 24, and page 26. No new matter has been entered.

Claim Rejections - 35 U.S.C. § 112

- The Examiner rejected claims 1-18 under §112, 1st paragraph, as failing to comply with the written description requirement for the reasons set forth in item 2 on pages 2-3 of the Office Action.

First, the Examiner asserts that component (a) is ambiguous, at least in part due to the recitation of " a ferrous-family metal powder or a non-ferrous-family metal powder". Further, the Examiner asserts that the original specification does not appear to provide support for a "non-ferrous-family metal powder", because it originally recited "a non-ferrous powder".

The Examiner's interpretation of the specification is mistaken in that the originally filed specification does, indeed, set forth "non-ferrous metal powder". For example, claim 1 as originally filed set forth, in pertinent part, the following:

... wherein a powder that is formed by a simple substance or a combination of a plurality of carbides of metals belonging to the IVa, Va and VIa families in the Periodic Table is mixed with a ferrous-family metal powder or non-ferrous metal powder having the same composition as the treatment target as a simple substance or a combination of a plurality of metals, and this is compressed and molded, and then preliminarily sintered to form a sintered electrode serving as a discharge processing electrode ...

The above passage can be rewritten without the modifying clauses as the following:

... wherein a powder ... is mixed with a ferrous-family metal powder or non-ferrous metal powder ..., and this is compressed and molded, and then preliminarily sintered to form a sintered electrode serving as a discharge processing electrode ...

Additional examples of support for "non-ferrous metal powder" appear in the specification as originally filed at: page 6, lines 6-7 and 22-23; page 7, lines 11-12; page 9, lines 14-15; page 10, lines 7-8, 22-23; and the paragraph bridging pages 20-21.

As seen in both of the above-noted versions of the original claim language, as well as on at least the above-noted pages, the specification does, indeed, set forth a "non-ferrous metal powder". Accordingly, as the path of least resistance, Applicants have amended the specification and claims so as to recite "non-ferrous metal powder" as set forth in the specification as originally filed.

Second, the Examiner asserts that an explanation for the change from "elute" to "melt" should be provided.¹ Accordingly, Applicants offer the following.

As the Examiner states in the last paragraph on page 2 of the Office Action, "eluting can include the process of melting ... [or] other means such as vaporization ...", and as described at page 21, lines 11 to 13 of the original specification, the present application teaches that "the ferrous-family metal such as Co starts to elute to be buried in gaps between carbides, thereby

¹ March 2, 2004 Office Action at the paragraph bridging pages 2-3.

forming a so-called solid solution". The term "solid solution" implies that the metal powder is not heated to form a gas. Therefore, one of ordinary skill in the art would understand that for the ferrous-family metal to be eventually buried in gaps between carbides to form a solid solution, the metal would be melted by the heating.

In light of the above, Applicants respectfully request that the rejection of claims 1-18 under §112, 1st paragraph, be withdrawn.

- The Examiner rejected claims 1-18 under §112, 2nd paragraph, as being indefinite. Specifically, the Examiner states that it is unclear whether component (a) may be any powdered material, or must be a metal (ferrous or non-ferrous family) powder. Applicants respectfully traverse this rejection because component (a) is clear as written.

Specifically, as noted above in connection with the rejection under §112, 1st paragraph, the original claim language does, indeed, set forth that one of the components is either a ferrous family metal powder, or non-ferrous metal powder. That is, the original language corresponding to component (a) did not set forth that the powder may be of any type, but specifically noted that it be a metal (either ferrous family or non-ferrous) powder.

In light of the above, Applicants respectfully request that this rejection under §112, 2nd paragraph, be withdrawn.

Non-Statutory Double Patenting

The Examiner rejected claims 1-18 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, 6, 8, 11, 12-14, 21-24, of US Patent 6,602,561 to Moro et al. (hereinafter Moro) in view of JP 08-300227 to Saito et al. (hereinafter Saito '227). Applicants respectfully traverse this rejection because the references fail to teach or suggest all the elements as set forth in the claims. Specifically, each of Moro and Saito '227 fails to teach or suggest varying the electrical conditions according to characteristics of the treatment target material. Accordingly, even assuming that one of ordinary skill in the art were motivated to combine Moro and Saito '227 as suggested by the Examiner, any such combination would still not teach or suggest varying the electrical conditions according to characteristics of the treatment target material, as presently claimed.

Claim Rejections - 35 U.S.C. § 102/103

- The Examiner rejected claims 1-3 and 7-12 under §102(b) as being anticipated by or, in the alternative, under §103(a) as being obvious over, Saito '227. Applicants respectfully traverse this rejection for the following reasons.

First, Applicants arguments as set forth on pages 20-23 of the Amendment as filed August 6, 2003 are still pertinent and, therefore, are incorporated herein by reference.

Second, the Examiner's interpretation of Saito '227 is mistaken. Specifically, the Examiner asserts that Saito discloses an exemplary WC + Co compound that is heat treated to 1100°C, and that because these parameters are consistent with examples in the present specification "it must be considered that the Saito et al (227 A) process inherently produces the effects as claimed."² Applicants respectfully disagree. Instead, the invention in Saito '227 starts from the undesirability of a completely sintered electrode, and then backs the process down from there to form an incompletely sintered electrode that still has sufficient strength and electrical resistance, whereas the presently claimed invention starts from a compressed powder structure and gradually heats it just to a point at which a component starts to melt so as to form an electrode that is approximately as hard as chalk.

Specifically, Saito '227 discloses compressing molding a WC-Co powder and incompletely sintering the molded powder at 1100°C for 30 minutes. See paragraph [0025] and Table 1. Saito '227 describes that if the molded powder is completely sintered at a complete sintering temperature, there is formed a strong electrode which is non-consumable and unable to cause a deposition on the treatment target. See paragraph [0035]. The higher the sintering temperature, the higher the relative density and, thus, the strength of the electrode formed. Therefore, according to Saito '227, it is desirable to sinter the molded powder at a temperature at which an electrode having a relative density of 50 to 90% is formed, such that the electrode has appropriate strength and electrical resistance. See paragraph [0036]. Saito '227 discloses choosing a condition at which the electrode material is deposited well on the treatment target in the first discharge process, and changing the polarity of the electrode and the discharge electrical

² March 2 Office Action at the paragraph bridging pages 5-6, lines 1-10.

condition so as to increase the hardness in the second discharge process. See, for example, paragraph [0051].

On the other hand, with the presently claimed invention, “it is essential not to raise the preliminary sintering temperature to approximately not less than 1100 degrees centigrade. The temperatures exceeding this temperature make the electrode too hard, resulting in a problem in which in the next discharging process, the electrode material comes off irregularly due to a thermal impact caused by arc discharging, failing to properly supply discharging between the electrodes, resulting in serious adverse effects to the quality of the coat film formed on the treatment target.” See, page 22, lines 13-22. Further, “the temperature inside the furnace is gradually increased so as to harden the green compact electrode to a degree, for example, approximately as hard as chalk so that it has sufficient strength to withstand a mechanical machining process and also is not hardened too much (this process is referred to as “preliminary sintering process’). In this state, the ferrous-family metal such as Co starts to elute to be buried in gaps between carbides thereby forming a so-called solid solution.” See page 21, lines 15-23. Furthermore, “conditions of the above-mentioned preliminary sintering process are different depending on electrode materials. However, this is determined preliminarily through experiments. For example, the sintering temperature is set approximately in the range of 400 to 1100 degrees centigrade.” See page 22, lines 7-12. That is, a temperature approaching—but not equaling or exceeding 1100°C—may be acceptable for different materials, but not for all materials.

As discussed above, in contrast to the presently claimed invention, Saito ‘227 chooses to sinter the compressed powder at 1100°C because, according to Saito ‘227, sintering is required for strengthening the compressed powder, but if the sintering temperature is too high, the electrode formed will be non-consumable and thus be unable to cause deposition on the treatment target. Nonetheless, Saito ‘227 desires a high relative density of 50-90% of theoretical density. However, around the sintering temperature as which the component (a) of the presently claimed invention starts to melt, the density of the electrode formed is scarcely affected by the temperature because contraction of the compressed powder is barely caused at that temperature. Rather, the density is mostly affected by the conditions in which the powder is compression

molded before sintering. Therefore, the temperature—at which the incompletely sintered electrode's relative density of 50 to 90% with respect to the density of a completely sintered electrode is achieved—according to Saito '227 is not equivalent to the temperature at which the component (a) is heated according to the invention. During the heating according to the present invention, the density of the powder realistically is not changed and is not adjusted to be 50 to 90% of completely sintered by the heating temperature; instead, the electrode formed in the presently claimed invention is heated only to the melting point of the lower melting point material—the fact that the resultant electrode is approximately as hard as chalk confirms that no substantial sintering takes place.

Moreover, the presently claimed invention differs from Saito '227 with respect to the electrical conditions.

For example, claim 1 sets forth that “electrical conditions at a time when an initial coating film ... is subjected to a discharging surface treatment, are altered in accordance with the characteristics of the treatment target material.” This arrangement makes it possible to easily form an electrode and also efficiently to form a thick, hard coat film within a desired area. See, for example, Fig. 3(b) and the associated description in the specification.

For example, as set forth in the paragraph bridging pages 24 and 25, depending upon whether a discharge is directly applied to the base member of the treatment target 2 (as shown in Fig. 3a), or is applied after the hard coat film 13 has been formed (as shown in Fig. 3b), electrical conditions including the discharge current value I_p , the discharge current pulse width τ_p and the pause time τ are properly altered so as to fit to the characteristics of the subject material. Moreover, depending upon the situation, the poles of the electrode are also changed; i.e., changing of the poles of the electrode, as in Saito '227, is not the same as altering the electrical conditions. Thus, because the base member and the hard coat film formed later are respectively different in material characteristics, and hardness, the electrical conditions are altered so as to fit to the characteristics of the subject material depending on whether a discharge is directly applied to the base member, or to the hard coat film. Consequently, the electrical conditions suitable for the corresponding subject material are adopted, so that it becomes possible to carry out the process in a shorter time, and also to form a hard coat film with high adhesion. Such electrical

conditions suitable for the respective characteristics of the subject material are preliminarily determined through experiments, and the control device 14 alters these conditions according to the characteristics of the subject material. As a non-limiting example, the alteration of each of the discharging current value I_p , the discharging current pulse width τ_p and the pause time τ_r , is carried out by switching operations of switches 15 and 16 and the controlling operations of the switching in the control circuit shown in Fig. 4.

In contrast, Saito '227 fails to teach or suggest this feature. Instead, Saito '227 discloses only switching the polarity of the electrodes so that the primary and secondary processes may be carried out with the same electrode.

For at least any of the above reasons, claims 1-3 and 7-12 are neither anticipated, nor rendered obvious, by Saito '227.

- The Examiner rejected claims 4-6 and 13-15 under §103(a) as being unpatentable over Saito '227 in view of JP 6-246,542 A to Mori (hereinafter Mori) or JP 63-210,280 A to Inoue (hereinafter Inoue) or US Patent 6,086,684 to Saito (hereinafter Saito '684).

Mori discloses a method in which a machining process is carried out by utilizing plasma in a gas atmosphere such as an inert gas. In contrast, claims 4 to 6 of the present invention, which are respectively dependent on claims 1 to 3, disclose an arrangement in which an inert gas is interpolated between the electrode and the treatment subject. This arrangement provides a function and effect that the device structure is simplified, and that the pole-to-pole gap is cooled, and that excessive electrode materials are carried out of the system.. See, for example, the specification at page 11, lines 15-20, page 16, lines 9-12, and page 28, lines 21-24. In the same manner, claims 13-15 of the present invention, which are respectively dependent on claims 10-12, disclose an arrangement in which an inert gas is interpolated between the electrode and the treatment subject. Again, this arrangement provides a function and effect that the device structure is simplified. Moreover, Mori fails to teach or suggest anything about the electrical conditions as set forth in Applicants' claims, and also fails to cure the above-noted deficiencies with respect to Saito '227.

The Examiner cites Inoue and Saito '684 as teaching various characteristics of the gas environment around the discharge electrode. But neither Inoue nor Saito '684 teaches or

suggests anything concerning the electrical conditions as set forth in Applicants' claims, and neither of these references cures the above-noted deficiencies with respect to Saito '227.

Accordingly, for the sake of argument, even assuming that one of ordinary skill in the art were motivated to combine Saito '227 with any of Mori, Inoue, or Saito '684 as suggested by the Examiner, any such combination would still fail to teach or suggest all the elements as set forth in Applicants' claims.

- The Examiner rejected claims 7-9 and 16-18 under §103(a) as being unpatentable over Saito '227 in view of JP 10-225,824 to Kagaku (hereinafter Kagaku), or JP 10-512 A to Saito et al. (hereinafter Saito '512), or JP 5-261624 A to Toshiba Tungaloy Co. (hereinafter Toshiba).

Saito '512 discloses a method and a device for relatively shifting a rotation tool and a surface treatment electrode, and Toshiba discloses a driving mechanism for relatively shifting a rotation electrode with respect to a treatment subject. In contrast, claims 7-9 of the present invention, which are respectively dependent on claims 1-3, disclose an arrangement for allowing an electrode to scan a treatment subject. Therefore, in addition to the functions and effects of claims 1-3 of the present invention, the following functions and effects are obtained: it is possible to use a small-size sintered electrode, and the process is carried out with this electrode being allowed to scan; it is not necessary to use a large-size sintered electrode having a specific shape, and it is possible to form a coating film with the small-size sintered electrode being allowed to scan on the entire face of the treatment subject, such as a mold, having a three-dimensional free curved face, so as to have a uniform thickness over the entire area or a varied film thickness, if necessary. In the same manner, claims 16-18 of the present invention, which are respectively dependent on claims 10-12, disclose an arrangement for allowing an electrode to scan a treatment subject in addition to the arrangement of claims 10-12. Thus, these claims exert the same functions and effects as claims 7-9 of the present invention, in addition to the functions and effects of claims 10-12 of the present invention. Moreover, Saito '512 fails to teach or suggest anything about the electrical conditions as set forth in Applicants' claims, and also fails to cure the above-noted deficiencies with respect to Saito '227.

Further, the Examiner cites Kaguku, Saito '512, and Toshiba, as teaching the use of X, Y, and Z movements to enable electrical discharge machining of 3-D objects.³ But Kaguku, Saito '512, and Toshiba do not teach or suggest anything concerning the electrical conditions as set forth in Applicants' claims, and these references fail to cure the above-noted deficiencies with respect to Saito '227.

Accordingly, for the sake of argument, even assuming that one of ordinary skill in the art were motivated to combine Saito '227 with any of Kaguku, Saito '512, or Toshiba, as suggested by the Examiner, any such combination would still fail to teach or suggest all the elements as set forth in Applicants' claims.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

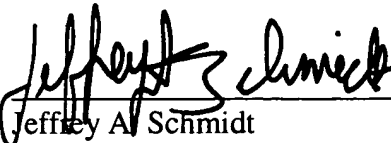
³ April 14, 2003 Office Action (incorporated by the March 2 Office Action) at the paragraph bridging pages 7 and 8.

Amendment Under 37 C.F.R. § 1.114(c)
U.S. Appln No. 09/872,421

Atty Dkt No. Q64554

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23373

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Date: September 2, 2004